Amendments to the Specification:

1. Page 1, before line 4, but after the title, please insert the following:

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a U.S. National Stage of International Application No. PCT/EP2005/000024, filed January 4, 2005, which claims priority of German Patent Application No. 10 2004 001 097.8, filed January 5, 2004.

BACKGROUND OF THE INVENTION

1. Field of the Invention

2. Page 1, before line 9, please insert the following:

2. Discussion of Background Information

3. Page 3, before line 23, please insert the following:

SUMMARY OF THE INVENTION

The present invention provides a metallic substrate having a deformable vitreous coating. The substrate is obtainable by a process comprising

(a) application of an alkali metal silicate-containing coating sol to the substrate to provide a coating layer; and

(b) thermal densification of the coating layer of (a) by a two-stage heat treatment.

The heat treatment comprises, in a first stage, a heat treatment carried out either (A) in an oxygen-containing atmosphere or (B) in a vacuum at a residual pressure of ≤ 15 mbar and, in a second stage, a heat treatment in a low-oxygen atmosphere up to full densification with formation of a vitreous layer.

In one aspect of the substrate, the heat treatment of the first stage may be carried out according to alternative (A) at an end temperature of up to about 400°C or, according to alternative (B), at an end temperature of up to about 500°C.

In another aspect of the substrate, the heat treatment of the second stage may be carried out at an end temperature in the range of from 400° to 600°C and/or in an inert gas atmosphere.

In another aspect of the substrate of the present invention, the process may further comprise a cooling of the heat-treated substrate in an oxygen-containing or low-oxygen atmosphere.

In yet another aspect of the substrate, the alkali metal silicate-containing coating sol may be obtainable by a process which comprises a hydrolysis and polycondensation of one or more silanes of formula (I)

R_nSiX_{4-n} (I)

wherein the radicals X independently represent hydrolyzable groups or hydroxyl groups, the radicals R independently represent hydrogen, alkyl, alkenyl and alkynyl groups having up to 4 carbon atoms and aryl, aralkyl and alkaryl groups having from 6 to 10 carbon atoms, and n is 0, 1 or 2, with the proviso that at least one silane where n = 1 or 2 is used,

or oligomers derived therefrom,

in the presence of

(a) at least one compound selected from oxides and hydroxides of alkali metals and alkaline earth metals, and

(b) optionally, nanoscale SiO_2 particles.

By way of non-limiting example, the at least one compound may be used in such an amount that an atomic ratio Si : (alkali metal and/or alkaline earth metal) is in a range of from 20:1 to 7:1, e.g., in a range of from 15:1 to 10:1, and/or the average value of n in the silanes of formula (I) may be from 0.2 to 1.5, e.g., from 0.5 to 1.0.

In a still further aspect of the substrate, the thickness of the vitreous coating may be from 1 to 6 μm, e.g., from 1.5 to 5 μm, or from 2.5 to 4.5 μm.

In yet another aspect, the substrate may have been subjected to a cold forming and/or may have a structured surface.

In yet another aspect, the substrate may comprise one or more metals selected from aluminum, tin, zinc, copper, chromium and nickel and/or the substrate may comprise steel, an aluminum alloy, a magnesium alloy and/or a copper alloy. For example, the substrate may comprise at least one of steel, stainless steel, zinc-plated steel, chromium-plated steel and enameled steel.

The present invention also provides a process for making a metallic substrate. This process is the process by which the metallic substrate of the present invention as set forth above (including the various aspects thereof) is obtainable.

In one aspect of the process, the heat treatment of the first stage may be carried out according to alternative (A) at an end temperature of up to about 400°C and/or the oxygen-containing atmosphere in the first stage may comprise from 15 % to 90 % by volume of oxygen.

In another aspect of the process, the heat treatment of the first stage may be carried out according to alternative (B) at an end temperature of up to about 500°C. For example, the heat treatment may be carried out at an end temperature of up to about 200°C and at a residual pressure of ≤ 5 mbar.

In yet another aspect of the process of the present invention, the heat treatment of the second stage may be carried out at an end temperature in the range of from 400° to 600°C. For example, the heat treatment of the second stage may be

carried out at an end temperature in the range of from 540° to 560°C and in an atmosphere which comprises ≤ 0.5 % by volume of oxygen, e.g., in an inert gas atmosphere.

In a still further aspect, the process may further comprise a cooling of the heat-treated substrate at a cooling rate of from 1 to 10 K/min.

DETAILED DESCRIPTION OF THE INVENTION